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IEA Solar Heating and Cooling Programme

Task 18

ADVANCED GLAZING
AND
ASSOCIATED MATERIALS FOR SOLAR AND BUILDING APPLICATIONS

B11 Angular optical properties

Optical Properties of Flat Coated and Uncoated Glass

W. J. Platzer

FhG-ISE
Oltmannsstr. 5, D-79100 Freiburg, FRG
Tel. +49-761-4588-131
Fax. +49-761-4588-132
email: platzer@ise.fhg.de

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Summary

Optical properties of different glass pieces were investigated. The series of samples (1993) consisted of float glass and K-glass from PILKINGTON and of float glass, ipasol neutral 52/38 and ipasol neutral 66/34 glass pieces from INTERPANE. The name of the coated glass pieces was taken from the names of the double glazed units (DGU) in which those pieces are being used. The related DGU were sent to participants of the projects B12, B13 and B14 and

have been measured as well. For all glass pieces the normal-hemispherical transmittance τ_{nh} and the near-normal hemispherical reflectance ρ_{nh} were measured for the spectral range 300-2500nm. From these data the integrated values for the solar transmittance and the visible transmittance were calculated, using the ASTM891 direct AM1.5 solar spectrum for the solar average. For some samples also the normal-diffuse transmittance τ_{nd} and the near-normal diffuse reflectance ρ_{nd}.were determined as well. The reflectance of coated samples has been measured for the front side (coated) and the back side (uncoated). No significant diffuse component of the reflectance could be seen.

Samples

The samples all had the size of 50mm x 100mm with thicknesses of 5 or 6 mm.

Measurement setup

The spectral measurements have been performed with a Perkin-Elmer Lambda-9 Photospectrometer with an $BaSO_4$-coated integrating sphere of 150mm diameter. The input slit for the sphere has a rectangular aperture of 23mm x 10mm and is illuminated by a beam with cross-section approximately 12mm x 6mm. The reference for the reflectance measurement is a tile from PTFE, calibrated by Labsphere. Due to ageing of the tile the reference error is believed to be maximal 1% of the signal, with a relatively large uncertainty in the ultraviolet below 350nm. The ageing of the tile is monitored by comparing every month with a primary reference. For the mainly specular reflectance the additional reflectance of the sample beam at the sphere wall is taken into account. However, this procedure is approximate as the wall reflectivity is not know exactly, and the detector view factors had been determined by comparing the signal of a silver mirror with the known reflectance curve.

Summary of optical properties

Table 1: Solar properties (AM1.5 Direct ASTM-E891)

Sample	τ_{nh} [%]	ρ_{nh} (front) [%]	ρ_{nh} (back) [%]
IP Float	81.5	7.7	7.7
IP Ipasol 52/38	36.5	27.4	20.3
IP Ipasol 66/34	34.9	44.0	32.8
Pilkington Float	79.0	7.4	7.4
Pilkington K-Glass	66.6	11.7	10.0

Table 2: Visible properties (Source D65 with sensitivity V(λ))

Sample	τ_{nh} [%]	ρ_{nh} (front) [%]	ρ_{nh} (back) [%]
IP Float	89.5	8.3	8.3
IP Ipasol 52/38	55.5	8.4	7.9
IP Ipasol 66/34	73.2	4.4	6.3
Pilkington Float	88.5	8.0	8.0
Pilkington K-Glass	81.7	11.6	10.9

Table 3: Selected Wavelengths (λ=500, 670 and 1500nm)

Sample	wavelength {nm}	τ_{nh} [%]	ρ_{nh} (front) [%]	ρ_{nh} (back) [%]
IP Float	500	90.2	8.4	8.4
	670	85.5	7.8	7.8
	1500	79.8	7.5	7.5
IP Ipasol 52/38	500	60.1	7.4	8.1
	670	46.5	11.3	9.3
	1500	12.7	68.4	50.2
IP Ipasol 66/34	500	73.5	5.5	5.4
	670	62.7	6.9	9.9
	1500	1.0	91.7	69.7
Pilkington Float	500	89.3	8.1	8.1
	670	83.7	7.4	7.4
	1500	76.8	7.4	7.4
Pilkington K-Glass	500	82.7	11.0	10.3
	670	79.2	8.9	8.5
	1500	53.0	5.1	6.2

Figures